Report

by the

NASA
Biological and Physical Research

Research Maximization
And Prioritization
(ReMAP) Task Force

to the

NASA Advisory Council
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PREFACE

The ReMAP committee deliberated for several months to establish, for the first time, priorities and goals for OBPR and ISS research across disciplines. ReMAP findings and recommendations rest on a large foundation of work of hundreds of scientists who worked for thousands of hours, over months and years, to prioritize research within each OBPR scientific discipline. It is noteworthy that the committee was successful, during meeting deliberations, in establishing a rationale and strategies for prioritization of the overall research program for OBPR and for ISS.

The findings and recommendations in this report provide a framework for prioritizing a productive research program for NASA's Office of Biological and Physical Research (OBPR) and for the International Space Station (ISS).

The report identifies two overarching programmatic goals.

- The first involves research enabling human exploration of space.
- The second involves basic research of intrinsic scientific interest.

The broad OBPR program encompasses research using the ISS, shuttle, free-flyers and ground-based capabilities.

- The ISS has unique features not available on any other vehicle, including human tended, long duration (>1mo) exposure to microgravity.
    - ReMAP prioritized work that can be done on ISS with the US Core Complete[1] configuration,
    - ReMAP identified enhancements to the US Core Complete configuration which will enable a science driven program of highest priority research.

The context for establishing the ReMAP Task Force is multifaceted:
The President's FY2003 budget states: "This year, NASA will be working with the White House Office of Science and Technology Policy (OSTP) to engage the scientific community and establish clear high-priority, affordable science objectives with near-term focus on improving scientific productivity. The results of this review will help set the science agenda for Biological and Physical Research that will in turn drive how the Space Station is used. It should increase the efficiency and output of research at the Station, and realign NASA's Research and Development portfolio to reflect current priorities."

The NASA Advisory Council (NAC) requested that NASA's Office of Biological and Physical Research (OBPR) act upon the International Space Station Management and Cost Evaluation Task Force (IMCE) conclusion: "Scientific research priorities must be established and an executable program, consistent with those priorities, must be developed and implemented."

In consultation with OSTP and the Office of Management and Budget (OMB), OBPR assembled an *ad-hoc* external advisory committee, the Biological and Physical Research Maximization and Prioritization (ReMAP) Task Force, to assist OBPR in establishing a prioritized program for its research portfolio.

[1] See definition, Appendix O

Basis of ReMAP activities:
The ReMAP Task Force has used the Terms of Reference (Appendix A) jointly developed by NASA, the OMB, and the OSTP, along with the charge to the Task Force from the NASA Administrator (delivered at the first and third meetings), to form the basis of its activities.

Acknowledgements:
The ReMAP Task Force commends the many dedicated NASA teams and contractor personnel who facilitated the compilation of this report. While these individuals provided extensive background information and offered constructive comments and suggestions, responsibility for the content of the final report rests entirely with the ReMAP Task Force. Further, the findings and recommendations in this report are those of the ReMAP Task Force.

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TABLE OF CONTENTS

1.0 Executive Summary

Perspective:
NASA has a stake in some of the biggest intellectual problems in science: the origin of life, the nature of the solar system, human exploration outside the planet, and the characterization of Earth from space. In several areas of biological and physical research, solutions of very large, important questions require microgravity. ISS provides a unique environment for attacking these problems "as only NASA can." The committee was unanimous in the view that the ISS is unprecedented as a laboratory and is the *only* available platform for human tended research on long-duration effects of microgravity.

The Task Force has made the following primary findings:

- OBPR research includes work that is best performed on ISS, as well as studies best done on the ground or on other platforms such as the Shuttle or free-flyers.
- The highest priority research for ISS falls into two broad categories: research emphasizing human exploration of space, and that emphasizing intrinsic scientific importance and impact, with some work meeting both goals. Prioritization between these categories is a NASA programmatic decision.
- The assignment of priorities was done at the level of OBPR research themes and not at the level of individual research projects. The ranking of priority 1 to a given theme area constitutes our statement that there are very important research questions within this research theme, and does not suggest a blanket endorsement of all the projects within an area.
- According to the preliminary OBPR Implementation Analysis for ISS presented to ReMAP, at "US Core Complete" and at "US+ IP Core Complete,"[2] the capability to do high priority research is limited due to constraints imposed by crew time and lack of upmass capacity.

The Task Force has made the following primary recommendations:

- **ISS Research Productivity:** NASA must resolve the upmass and crew research time issues.
- **Current ISS Productivity:** As ISS nears completion, NASA should increase science priority and productivity on ISS.
- **Basic Research:** OBPR should include in its high-priority research portfolio, outstanding basic scientific research programs that address important questions in the physical and biological sciences, and which require long-term experiments on the ISS, based on their intrinsic scientific value.
- **Implementation of ISS Research Facilities:** NASA should ensure the implementation of high priority facilities, such as the centrifuge and habitats.

[2] See definitions, Appendix O

- **Fully Utilize Available Options for Space Research:** NASA should consider additional Shuttle science/commercial flight opportunities.
- **Science on ISS:** If enhancements to ISS beyond US Core Complete are not anticipated, NASA should cease to characterize the ISS as a science driven program.
- **Coordination with International Partners:** NASA should continue coordination of facilities development and research solicitations with the International Partners (IP), and attempt to address the IP concerns.